Assessment Schedule – 2020

Physics: Demonstrate understanding of electricity and electromagnetism (91173)

Q	Evidence	Achievement	Merit	Excellence
ONE (a)	$\frac{1}{R}=\frac{1}{6}+\frac{1}{6}$ so $R=3$, or $R=\frac{6\times6}{6+6}=3$	• Show question.		
(b)	$R_T=3+\left(\frac{1}{10}+\frac{1}{10}\right)^{-1}=8\,\Omega$ $I=\frac{28}{8}=3.5\text{ A}$	• Finds total R (8). OR 28 / (any calculated R – not 3).	• 3.5 A	
(c)	When the foot heater stops working, this increases the total resistance of the circuit. This reduces the total current in the circuit. This reduces the current in each hand unit.	• Total resistance increases • Current through hand unit decrease.	• Correct answer with reasoning. • Must be clear that it's the current in the hand unit being referred to.	
(d)	$P=IV=\frac{V^2}{R}$ $120=\frac{28^2}{R}$ so $R_{total}=6.533\,\Omega$ $R_{total}=6.533\,\Omega=3+\left(\frac{1}{10}+\frac{1}{10}+\frac{1}{R}\right)^{-1}\Rightarrow R=12\,\Omega$ OR $I=\frac{P}{V}=\frac{120}{28}=4.29\text{ A}$ Voltage across hand units $=3\times4.29=12.9\text{ V}$ Voltage across foot units $=28-12.9=15.1\text{ V}$ $R_{\text{foot combo}}=\frac{V}{I}=\frac{15.1}{4.29}=3.52\,\Omega$ So $\left(\frac{1}{10}+\frac{1}{10}+\frac{1}{R}\right)^{-1}=3.52$ And $R=12\,\Omega$	$I=4.29\text{A}$	$R_{\text{foot combo}}=3.52\,\Omega$ Or Finds $R_{total}=6.533\,\Omega$	• 12.0 Ω OR States a correct formula from which R could be calculated, e.g.: $6.533=3+\left(\frac{1}{10}+\frac{1}{10}+\frac{1}{R}\right)^{-1}$ OR equivalent.

Q	Evidence	Achievement	Merit	Excellence
TWO (a)	$d = \frac{V}{E} = \frac{1.75\times10^{8}}{8.57\times10^{4}} = 2042$ m	• Correct answer.		
(b)	$F = Eq = 8.57\times10^{4}\times3.7\times10^{-6} = 0.317 = 0.32$ N Upwards	• Direction or force.	• Correct answer and direction.	
(c)	The field between the plates is uniform. This means that it has constant strength and direction. $F = Eq$, the charge and the field are constant, so the force is constant.	• Uniform field or constant force.	• Constant force and constant/uniform field.	
(d)	Energy gained $= \frac{1}{2}\times9.1\times10^{-31}\times\left(4.2\times10^{5}\right)^{2} - \frac{1}{2}\times9.1\times10^{-31}\times\left(1.2\times10^{5}\right)^{2}$ $= 7.37\times10^{-20} = Eqd = 8.57\times10^{4}\times1.6\times10^{-19}\times d$ $d = 5.37\times10^{-6}$ m	• Found one E_k. OR • Realised $\frac{1}{2}mv^{2} = Eqd$ • Calculates a d but writes down the E_k.without the v squared.	• Finds d by using either of the given speed	• Correct answer. 5.37×10^{-6} OR 5.37×10^{-6} (missing the squaring on the energies).

<table>
<tr><th>Q</th><th>Evidence</th><th>Achievement</th><th>Merit</th><th>Excellence</th></tr>
<tr><td>THREE
(a)</td><td>$V = BvL = 40\times10^{-6}\times236\times68.4 = 0.646$ V</td><td>• This is a show question.</td><td></td><td></td></tr>
<tr><td>(b)</td><td>
<table>
<tr><th>Action</th><th>Effect on size of induced voltage</th><th>Which colour wing is positive</th></tr>
<tr><td>Speed of plane increases</td><td>Voltage increases</td><td>Red</td></tr>
<tr><td>Plane is flown in opposite direction at the same speed</td><td>Voltage stays the same
No effect/ no change etc</td><td>Red</td></tr>
<tr><td>Plane flies vertically upwards from the Earth</td><td>No voltage (accept lowers)</td><td>None
Accept neutral or equivalent not both</td></tr>
</table>
</td><td>• TWO correct entries.</td><td>• FOUR correct entries.</td><td>FIVE correct entries.</td></tr>
<tr><td>(c)</td><td>$I = \frac{28}{5} = 5.6$ and $F = BIL = 4\times10^{-5}\times5.6\times5.9 = 1.32\times10^{-3}$ N
Direction is left.</td><td>• Force OR direction given.</td><td>• Force AND direction given.</td><td></td></tr>
<tr><td>(d)</td><td>The wire is cutting through the magnetic field, and there is voltage induced on the wire, which is equal to the voltage induced on the wings. This makes the red wing tip and the “red” end of the wire positive and no current flows, meaning the lamp will never go, so the arrangement would be no good as a speed-warning device.</td><td>• Accept if speed increases induced voltage on plane increases. Or opposite.</td><td>• Voltage induced on wire increases as speed increases or explains how there is a voltage on the wire..</td><td>• The lamp won’t go – with correct reason</td></tr>
</table>

For all questions:

Not Achieved			Achievement		Achievement with Merit		Achievement with Excellence	
NØ	**N1**	**N2**	**A3**	**A4**	**M5**	**M6**	**E7**	**E8**
No response; no relevant evidence.	Very little Achievement evidence.	Some evidence at Achievement level, but most is at Not Achieved level.	A majority of the evidence is at the Achievement level.	Most evidence is at Achievement level.	Some evidence is at Merit level.	A majority of the evidence is at Merit level.	Evidence is provided for most tasks. The evidence at Excellence level may have minor errors, or the evidence is weak.	Evidence is provided for most tasks. The evidence at Excellence level is accurate.
–	1a	2a	3a	4a	1m + 3a	2m + 2a	1e + 2m	1e + 2m + 1a

Other combinations are possible: Counting a=1, m=2 e=3 and you need to have at least one e to get E7.

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 7	8 – 14	15 – 19	20 – 24